What is claimed is:

Fig 1-10

1. A fuel assembly for a nuclear reactor including a plurality of elongated nuclear fuel rods having an extended axial length, at least a lowermost grid supporting said fuel rods in an organized array and having unoccupied spaces defined therein adapted to allow flow of fluid coolant therethrough and past said fuel rods when said fuel assembly is installed in the nuclear reactor and a plurality of guide thimbles extending along said fuel rods through and supporting said grid, a debris filter bottom nozzle disposed below said grid, below lower ends of said fuel rods, supporting said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly, said debris filter bottom nozzle comprising a substantially horizontal plate extending substantially transverse to the axis of the fuel rods and having an upper face directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different types of holes, the first type being a plurality of holes receiving lower ends of said guide thimbles where they are supported by said plate and the second type being a plurality of flow through holes extending completely through said plate for the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces, and in the extended direction at least some of said coolant flow through holes having a profile substantially of a venturi.

102(b) A or 102(b) B

Fig 7 (48)

OBVIOUS to use Fig 8 Holes For Fig 7

103(a) A

Fig 8

2. The nuclear fuel assembly of Claim 1 wherein said coolant flow through holes having a profile substantially of a venturi has an inlet end in the lower face of said plate and an outlet end in the upper face of said plate wherein the venturi is substantially formed by a chamfer in said inlet end and said outlet end.

103(a) A

Fig 8

OBVIOUS ~~to smooth it out~~ TURN UPSIDE DOWN Beveled edge

3. The nuclear fuel assembly of Claim 2 wherein the inlet chamfer is a double angle chamfer.

103(a) A

Fig 8

4. The nuclear fuel assembly of Claim 3 wherein the double angle chamfer approximates a curved surface.

OBVIOUS TO SMOOTH IT OUT mechanical paper practices

8. The nuclear fuel assembly of Claim 4 wherein the chamfers have the following dimensions and angles relative to a flow axis of the flow through hole where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and Chamfer C is at the outlet of the flow through holes.

	Angle	Nominal Length (in.)	Maximum Length (in.)	Minimum Length (in.)
Chamfer A	35° ± 3°	0.017 (0.043 cm)	0.039 (0.099 cm)	0.012 (0.030 cm)
Chamfer B	15° ± 3°	0.039 (0.099 cm)	0.057 (0.145 cm)	0.010 (0.025 cm)
Chamfer C	10° ± 3°	0.085 (0.361 cm)	0.142 (0.361 cm)	0.059 (1.397 cm)

9. The nuclear fuel assembly of Claim 4 wherein the chamfers have the following relative dimensions and angles with regard to a flow axis of the flow through hole where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and Chamfer C is at the outlet of the flow through holes and L/T is the length of the chamfer divided by the thickness of the plate.

	Angle	Chamfer L/T	
		Maximum	Minimum
Chamfer A	2.33 x B	0.071	0.020
Chamfer B	15° +/- 3°	0.104	0.017
Chamfer C	0.67 x B	0.258	0.101

7. The nuclear fuel assembly of Claim 1 wherein substantially every coolant flow through hole not associated with a guide thimble has the venturi profile in the extended direction.

8. The nuclear fuel assembly of Claim 1 including support means adapted to support said fuel assembly when installed in the nuclear reactor with said plate fixed at its periphery on said support means.

9. The nuclear fuel assembly of Claim 1 wherein the coolant flow through holes have a substantially circular cross-section.

~~10.~~ The nuclear fuel assembly of Claim 9 wherein the coolant flow through holes have a 0.190 +/-0.008 inch (0.48 +/- 0.02 cm) or less diameter at their narrowest cross-section.

~~11.~~ The nuclear fuel assembly of Claim 9 wherein the through coolant flow through holes are packed in a density of about 16 per square inch.

~~12.~~ A debris filter bottom nozzle for a nuclear reactor fuel assembly ~~having a plurality of elongated nuclear fuel rods having an extended axial length, at least a lowermost grid supporting said fuel rods in an organized array and having unoccupied spaces defined therein adapted to allow flow of fluid coolant therethrough and past said fuel rods when said fuel assembly is installed in the nuclear reactor, a plurality of guide thimbles extending along said fuel rods through and supporting said grid, said debris filter bottom nozzle designed to be disposed below said grid, below lower ends of said fuel rods, to support said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly~~, said debris filter bottom nozzle comprising a substantially horizontal plate extending substantially transverse to the axis of the fuel rods and having an upper face to be directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different types of holes, the first type being a plurality of holes for receiving lower ends of said guide thimbles where they are to be supported by said plate and the second type being a plurality of flow through holes extending completely through said plate for the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes when incorporated in said fuel assembly, extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces, and in the extended direction at least some of said coolant flow through holes having a profile substantially of a venturi.

~~13.~~ A fuel assembly for a nuclear reactor including a plurality of elongated nuclear fuel rods having an extended axial length, at least a lowermost grid supporting said fuel rods in an organized array and having unoccupied spaces defined therein adapted to allow flow of fluid coolant therethrough and past said fuel rods when said fuel assembly is installed in the nuclear reactor, a plurality of guide thimbles

extending along said fuel rods through and supporting said grid, a debris filter bottom nozzle disposed below said grid, below lower ends of said fuel rods, supporting said guide thimbles and adapted to allow flow of fluid coolant into said fuel assembly, said debris filter bottom nozzle comprising a substantially horizontal plate extending substantially transverse to the axis of the fuel rods and having an upper face directed toward said lowermost grid, said upper face of said plate having defined therethrough at least two different types of holes, the first type being a plurality of holes receiving lower ends of said guide thimbles where they are supported by said plate, the second type being a plurality of flow through holes extending completely through said plate for the passage of coolant fluid from a lower face of said plate to the upper face of said plate, each of said coolant flow through holes extending substantially in the axial direction of said fuel rods, in fluid communication with said unoccupied spaces, and at least some of said coolant flow through holes having a double inlet chamfer.

~~14~~. The nuclear fuel assembly of Claim 13 wherein the double angle chamfer approximates a curved surface.

~~15~~. The nuclear fuel assembly of Claim 13 wherein all of the coolant flow through holes not associated with a guide thimble include the double angle inlet chamfer.

~~16~~. The nuclear fuel assembly of Claim 13 wherein the chamfers have the following dimensions and angles relative to a flow axis of the flow through hole where Chamfer A is the chamfer closest to an inlet of the flow through hole and Chamfer B is the chamfer adjacent Chamfer A, spaced from the inlet.

	Angle	Nominal Length (in.)	Maximum Length (in.)	Minimum Length (in.)
Chamfer A	35° ± 3°	0.017 (0.043 cm)	0.039 (0.099 cm)	0.012 (0.030 cm)
Chamfer B	15° ± 3°	0.039 (0.099 cm)	0.057 (0.145 cm)	0.010 (0.025 cm)

17. The nuclear fuel assembly of Claim 4 wherein the chamfers have the following relative dimensions and angles with regard to a flow axis of the flow

through hole where Chamfer A is the chamfer closest to the inlet, Chamfer B is the chamfer adjacent Chamfer A and Chamfer C is at the outlet of the flow through holes and L/T is the length of the chamfer divided by the thickness of the plate.

	Angle	Chamfer L/T	
		Maximum	Minimum
Chamfer A	2.33 x B	0.071	0.020
Chamfer B	15° +/- 3°	0.104	0.017